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Regulating Market Risk in Banks

A Comparison of Alternative Regulatory Regimes

Constantinos Stephanou

Market risk is an increasingly important issue for banks and so for bank regulation.

Stephanou compares three approaches to setting risk-based capital adequacy standards: the building-bloc approach, the internal models approach, and the precommitment approach.



Summary findings

Regulators have traditionally used simple models to measure banks' capital adequacy. That is no longer possible as banks face increasing, and increasingly opaque, market risk.

Stephanou evaluates three approaches to regulating market risk in banks on the basis of efficiency, competitive neutrality, and effectiveness in regulation. Each approach is judged on how well it fulfills the aims of regulation without overburdening the financial system with the cost of regulation.

Ideally, all four types of risk — market, credit, legal, and operating risk — should be measured institution-wide before regulators set risk-based capital standards. That time has not yet come. In the meantime, piecemeal capital requirements remain the norm.

Stephanou focuses on market risk — any market-related factor that affects the value of a position in a financial instrument or portfolio of instruments. He analyzes the three basic approaches to regulating market risk in banks:

- The building bloc approach, which has been adopted in the European Union in the form of the Capital Adequacy Directive and also appears in the standardized version of the Basle Amendment to the Capital Accord to incorporate market risks.
- The internal models approach, incorporated recently in the Basle Amendment.
- The precommitment approach, a promising, recently arrived approach that has not yet been officially discussed.

Stephanou concludes — given the current inability to develop measures that capture an institution's overall portfolio risks — that piecemeal regulatory capital requirements (such as the one for market risk) are necessary. Of the approaches analyzed here, Stephanou considers the internal models approach to be, for the time being, the most reliable, market-friendly, and effective method that can be eventually achieved for many banks.

This paper — a product of the Financial Sector Development Department — is part of a larger effort in the department to study bank regulatory issues. Copies of the paper are available free from the World Bank, 1818 H Street NW, Washington, DC 20433. Please contact Priscilla Infante, room G8-115, telephone 202-473-7642, fax 202-522-3199, Internet address pinfante@worldbank.org. December 1996. (40 pages)

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**Financial Sector Development Department
The World Bank**

REGULATING MARKET RISK IN BANKS

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I. INTRODUCTION

There are four major categories of risk that arise in financial institutions in general, and banks in particular: market risk, credit risk, legal risk, and operating risk¹. The focus of this paper is on market risk, which refers to any market-related factor (for example, an interest rate change) that alters the value of a position in a financial instrument or portfolio of instruments. The primary purpose is to assess the different regulatory regimes that have been either proposed, or already implemented, in order to incorporate market risk explicitly into the framework of risk-based minimum capital standards for banks.

Section II offers a brief overview of the types of market risk, the rationale for financial regulation in the form of minimum capital standards for banks, and the three main regulatory approaches to measuring and setting capital against market risk. Sections III, IV and V describe and assess the three basic approaches to the regulation of market risk in banks:

- the building bloc approach, which has been adopted in the EU in the form of the CAD, and also appears in the standardized version of the Basle market risk standard;
- the internal models approach, which has been incorporated lately in the Basle market risk standard;
- the precommitment approach, which has been a very recent, though promising, arrival to the scene, and has not yet been officially discussed.

¹ For a comprehensive discussion see Group of Thirty (1993). In addition, there is systemic risk, which occurs if any of the previous four risks, individually or in combination, cause a disruption to a firm, that in turn causes widespread difficulties at other firms, in other market segments, or in the whole financial system.

The assessment is based on how well the delicate balance between fulfilling the aims of regulation and not overburdening the financial system is preserved in each of the three approaches. Finally, Section VI presents the main conclusions and draws the business implications of the alternative regulatory approaches.

II. THE REGULATION OF MARKET RISK IN BANKS

II.1. Types of Market Risk

There exist six fundamental market-type risks that can affect adversely the value of a portfolio of securities²:

- absolute price or rate (delta) risk - the exposure to a change in the value of a transaction (f) or portfolio (Π) corresponding to a given change in the price (S) of an underlying asset ($\Delta = \partial f / \partial S$);
- convexity or gamma risk - the exposure of the portfolio's delta with respect to the price of the underlying asset ($\Gamma = \partial^2 \Pi / \partial S^2$). The greater the non-linearity of the relationship between S and Π (for example, if options are part of the portfolio), the greater is gamma;
- volatility or vega risk - typically associated with options, it is the exposure to a change in f or Π resulting from a given change in the expected volatility (σ) of the price of an underlying asset ($\Lambda = \partial \Pi / \partial \sigma$);
- time decay or theta risk - typically associated with options, it is the (inevitable) exposure to a change in f or Π resulting from the passage of time t ($\Theta = \partial \Pi / \partial t$);
- basis or correlation risk - the exposure to a change in f or Π resulting from differences in the price performance of the derivatives it contains and their hedges;
- discount rate or rho risk - the exposure to a change in f or Π resulting from the change in the interest rate (r) used for discounting future cash flows (rho = $\partial \Pi / \partial r$). It measures the sensitivity of the value of a portfolio to interest rates.

Each of the six risks outlined above can be measured across the different maturities of the instruments in the portfolio. Once the portfolio has been decomposed into its component parts - that is, once the market risk of each particular product is broken down into its fundamental elements - the various risks can be aggregated and managed on a net basis.

² See Hull (1993).

Modern portfolio theory suggests that only an overall portfolio approach, consisting of all the bank's positions, is the appropriate way to measure risk. This is because the marginal contribution that a given position makes to total portfolio risk is a function of what else there is in the portfolio, which is another way of saying that risk is context-dependent. Any appropriate system for setting capital requirements should recognize this basic tenet of portfolio theory. With respect to portfolios of derivatives³ and underlying securities, therefore, the relevant market risk exposure for financial institutions is their unhedged and undiversified portion, that is the residual exposure after taking account of the netting out, of correlation, and of portfolio diversification of positions in the same or different instruments.

II.2. Objectives and Techniques of Bank Regulation, and the Sources of Bank Risk⁴

II.2.1. Objectives of Bank Regulation

A market-based financial system relies on the existence of prudential, organizational and protective regulations⁵, in order to preserve the safety and soundness of the financial system, to ensure its smooth functioning, and to provide adequate protection to users of financial services.

The particular business characteristics of banks have important implications regarding the need for their regulation. The need for bank regulation, given the objective of maintaining confidence in the financial system, arises from the fact that banks are

³ Derivative instruments are securities whose value depends on the values of other basic underlying assets. They fall into four main market groups: interest rate contracts, foreign exchange contracts, commodity contracts, and equity contracts. The first two groups are the dominant and older segments of the market. The instruments themselves consist of two basic types depending on their relationship with the underlying asset prices, those with linear payoffs (for example, forward contracts) and those with non-linear payoffs (for example, option contracts).

⁴ See Dale (November 1994).

⁵ See Vitas (1991).

uniquely vulnerable to contagious (systemic) illiquidity and insolvency collapse⁶, and their failures can cause severe negative social externalities.

In order to prevent costly bank runs, authorities provide protection to depositors through either formal deposit insurance schemes or informal support operations. Because the prospect of such protection tends to undermine market discipline by making depositors less careful where they place their money (moral hazard), thus permitting risky banks to take advantage of this safety net by choosing lower capital ratios than they would otherwise do, regulators seek to constrain risk-taking in order to limit the claims on the deposit insurance fund and/or the taxpayer⁷. The limited ability to price through risk-related premiums, or ration through limited coverage, the benefits of the safety net (especially the deposit insurance component), turn the government effectively into the largest uninsured creditor of banks, forcing it to resort to the use of regulatory capital requirements⁸.

At the same time, however, the fulfillment of the aforementioned prudential regulatory objective is subject to the following constraints:

- that it must not discriminate between institutions providing the same functions, that is it should maintain a level playing field (“competitive neutrality”);
- that it must not distort portfolio choices by imposing substantial compliance costs, and thus reduce the risk-transfer efficiency of the banking system. There is therefore a trade-off between the cost of imposing capital requirements and the costs of default⁹. Given this trade-off, the optimal capital structure of a financial institution from a social viewpoint inevitably exposes society to

⁶ This inherent vulnerability comes from the liquid nature of banks’ liabilities (deposits) and the illiquid nature of their assets (commercial loans), as well as the fact that banks’ assets are generally worth significantly less in liquidation than on a going-concern basis. See Diamond and Dybvig (June 1983).

⁷ See Buser et al. (March 1981) for the notion of capital regulation as an implicit premium for deposit insurance.

⁸ Dewatripont and Tirole (1994) offer a similar justification: “The main concern of prudential regulation is the solvency of banks... the goal of regulation is to provide active representation for depositors.”

⁹ For example, Berger et al. (1995) state: “Thus, capital regulation involves a tradeoff between the marginal social benefit of reducing the risk of the negative externalities from bank failures and the marginal social cost of diminishing intermediation.”

some risk¹⁰. Under the present piecemeal approach to capital standards, a more limited condition to the above is that the standard has risk weights consistent with the individual positions' contributions to the risk component for which the standard is being applied.

Finally, the international harmonization of rules is another important objective nowadays, in order to prevent regulatory arbitrage and to reduce compliance costs.

II.2.2. Techniques of Bank Regulation

The techniques of bank regulation that have evolved reflect the aforementioned regulatory objectives. Due to their inherently illiquid nature, banks typically have access to a lender of last resort facility, which is also related to the banks' important role in the payments system and in the transmission mechanism of monetary policy. In addition, there are other, implicit or explicit, measures of the regulatory safety net which protect the safety and soundness of banks. On the need to maintain solvency in difficult economic times, as well as to prevent moral hazard behavior arising from the existence of the safety net, it is the function of bank capital to provide a permanent cushion against unexpected losses, enabling individual banks, as well as the whole financial system, to survive.

The concept of capital adequacy relates the riskiness of a bank to the amount of capital, with minimum capital standards being the minimum permissible amount of capital in a bank. Risk-based capital standards seek to replace depositor pressures to limit bank risk-taking with regulator-required increases in capitalization as a bank's operations become riskier. In this regulatory definition of capital, bank supervisory authorities must define the balance sheet instruments that comprise the capital resources of a bank, in order to determine compliance with the minimum capital standards^{11, 12}.

¹⁰ In contrast to the well-known Modigliani-Miller irrelevance proposition, the many distortions that exist in financial markets (such as taxes, asymmetric information, and transaction costs) mean that additional capital requirements are costly since the weighted average cost of capital increases with the capital ratio. The implication is that capital requirements should not be arbitrarily large.

¹¹ Historically, measures of capital standards were based on various leverage ratios, usually expressing the amount of capital as a percentage of the bank's total assets. The growth of off-balance sheet activity and

II.2.3. Sources of Risk for Banks

In their traditional banking business - lending financed by deposits from customers or the wholesale markets - the main sources of risk for banks, as well as their regulation, were credit risk in their loan books and internal control systems. Credit risk was accounted for in the 1988 Basle Capital Accord, which provided for the first time minimum credit risk-based capital standards. The Basle framework now serves as the standard for all banks in numerous countries within and outside the G-10 group.

Banks may also be exposed to securities market risk because they have lent to investment firms and they hold securities as collateral, because they engage in trading business off their own balance sheets, or because they have securities subsidiaries or affiliates. Whereas, though, the first of these exposures can be dealt with, at least in principle, through regulatory limits on large exposures, the other two exposures inextricably link the bank's solvency to its securities operations. In effect, therefore, the bank's capital stands behind its securities unit.

Recent attempts to incorporate market risk into the framework of risk-based capital standards are largely based on the deregulation of interest rates, the dismantling of capital controls, and the relaxation of banks' authorized range of activities¹³. These developments have permitted the rapid growth in securities, foreign exchange, and derivatives (especially over-the-counter or OTC) trading by banks. Whereas exchange-traded derivatives are extensively regulated by government agencies, it is the unregulated nature of OTC derivatives trading, as well as its fast growth¹⁴, that is causing concern.

the existence of widely divergent classes of assets and instruments, which can greatly vary bank risks, has rendered the use of total assets an increasingly imperfect proxy for the relative risks of an institution.

¹² Modern capital regimes often classify regulatory capital into two Tiers: "core" capital, incorporating the highest elements (for example, equity and disclosed reserves); and "secondary" or "supplemental" capital, incorporating elements that have the capacity to absorb unexpected losses but are less permanent in nature - for example, various debt instruments such as subordinated debt. See The World Bank (August 1992), and Berger et al. (1995) for a discussion on the role and concept of capital in financial institutions.

¹³ See Weston and Gray (December 1994).

¹⁴ The standard way to judge the size of OTC derivatives is by reference to the notional amount outstanding for particular types of derivatives. The notional amount is the face value of the principal of the

Because trading-book exposures are taken with a view to resale or short-term profit, rather than to holding the securities until maturity, the assets are treated as short-term and valued on a mark-to-market basis - the current price at which they could be sold in the market.

Though it is widely agreed that the risks for end users or dealers involved in derivative activities are not new, derivatives business has two special attributes which distinguish it from more conventional financial activity¹⁵: increased complexity and rapid risk transformation. The result is reduced transparency of financial markets and an inability to correctly assess the risks of a financial institution. The concerns here are that firstly, trading desk activities may lead to rapid changes in bank capital because of the potential volatility of the trading portfolio's value; and secondly, the failure of large banks involved in derivatives may have systemic implications. In effect, the heavy social costs associated with bank failures are carried over into the securities markets. Globalization, by increasing the potential for transmission of cross-border financial contagion, has expanded those risks. This has been a primary motivation for the explicit introduction of market risk into risk-based capital adequacy standards.

II.3. Alternative Approaches to Market Risk Capital Standards

There are three main regulatory approaches to the measurement of, and the capital provisions for, market risk^{16,17}. The first one, which is the Building Blocs Approach (BBA), consists of a single model to be applied to all banks. It is a set of rules that assigns risk charges to specific instruments and crudely accounts for selected portfolio

underlying contract on which a derivative instrument is based. This is a misleading indicator of the size of derivatives transactions because most cash flows arising from such transactions are small compared with notional principal. The latter is useful, though, as a crude measure of the relative importance of one type of derivative compared with another, or as a measure of the growth in activity for one instrument.

¹⁵ See Dale (January 1995).

¹⁶ Other approaches for setting position (market) risk requirements, such as the US SEC's Comprehensive Approach and the UK Simplified Portfolio Approach are not discussed here, primarily because they apply to securities firms only. See Dimson and Marsh (July 1995).

¹⁷ The following description is based on Kupiec and O'Brien (December 1995).

effects on banks' risk exposures. This approach is characterized by a "building bloc" framework, a framework it shares with the 1988 Basle Accord credit risk capital standards. Two regulatory frameworks, those of the Capital Adequacy Directive (CAD) of the European Union and of the Basle Standardized Measure (BSM), incorporate this approach. In both cases, the required market risk capital will supplement the regulatory capital required under the current credit risk capital standards.

A second approach is the Internal Models Approach (IMA), whereby capital charges would be based on market risk estimates from banks' internal risk measurement models. The bank would use its proprietary risk measurement model to estimate its trading risk exposure which, when multiplied by a certain scaling factor as a measure of regulators' conservatism, would become the basis for the regulatory capital charge for market risk. Regulators would also impose a number of standardizing restrictions on banks' internal models, in order to ensure rough comparability across banks that use this approach. The IMA has been adopted recently by the Basle Committee as an alternative measure to the BSM.

The third and latest proposal is the Precommitment Approach (PA), based on work done by two Federal Reserve economists, Kupiec and O'Brien¹⁸. Under this approach, which has not yet been officially suggested or operationally described in great detail, each bank precommits to a maximum loss exposure over a designated horizon. The maximum loss commitment becomes the bank's market risk capital charge. If the bank incurs trading losses in excess of its capital commitment, it is subject to penalties which may include fines, a capital surcharge in future periods, or other regulatory disciplinary measures. The next three Sections will describe and assess in greater detail these three approaches respectively.

¹⁸ See, for example, Kupiec and O'Brien, "Model Alternative" in *Risk* magazine, Vol. 8, No. 6 (June 1995).

III. THE BUILDING BLOCS APPROACH

III.1. The Capital Adequacy Directive (CAD)

III.1.1. Background to the CAD

The EU, eager to put in place a key element of its Internal Market program by the target date of end-1992, decided to proceed unilaterally on the regulation of market risk with the CAD, though it did consult closely with the Basle Committee. A key provision, however, allows the CAD to be reviewed within three years of coming into effect (that is, by 31 December 1998), in the light of the evolving international consensus.

III.1.2. Aims of the CAD

The aims of the CAD are to ensure that all EU investment firms and credit institutions (banks) hold sufficient capital to cover the market risks to which they are exposed, and to promote the leveling of the playing field between different EU countries' banks and investment firms. To achieve these objectives, the CAD establishes¹⁹:

- a common framework for measuring and monitoring a range of market related risks;
- a large exposures regime for market risks;
- minimum capital requirements for investment firms and credit institutions;
- a definition of capital in order to meet the capital requirements.

III.1.3. The Concept of the Trading Book

Central to the CAD is the concept of the trading book. The trading book comprises both the short-term proprietary position taken by a bank in financial instruments for its own account, and its exposures relating to the provision of financial services to customers - for example, agency business. On the other hand, the banking

¹⁹ See Price Waterhouse (1994).

book comprises all other transactions - for example, lending and other types of credit activities, and long-term investments.

The trading book approach permits banks to engage freely in securities activities either directly, or through securities subsidiaries. In either case, the banking business activity is separated from the capital adequacy provisions of the trading book²⁰. Position risk within the trading book is the principal target of supervision under the CAD. However, the Directive also contains additional protective measures via an extra capital set-aside in relation to:

- settlement/delivery, counterparty and large exposures risks, in activities subject to market risks - that is, arising from the trading book only;
- foreign exchange and commodities risks, arising from all business activities.

Market risk that arises in banking book debt and equity instruments is not considered.

III.1.4. Framework for Measurement of Market Risk and for Capital Requirements²¹

Under this approach, capital charges are determined separately for each of four major market risk categories (interest rate, foreign exchange, equity, and commodities) and are then aggregated. The fundamental structure is therefore additive, while different procedures are used for each category to determine the respective capital charge.

The CAD divides market risk on both debt and equity instruments into two components in order to calculate the required capital. The first is specific risk and the second is general risk. Specific risk relates to circumstances particular to an issuer/issue, for example the deterioration in its financial position. General risk factors affect the market or the economy as a whole, for example changes in monetary policy²².

²⁰ See Dale (November 1994) for a discussion on the choice of regulatory regimes available to those negotiating the CAD. Briefly, these were: the separation (Glass-Steagall) model, the universal bank (mixed banking and securities firm) model, the firewall (restrictions on intra-group transactions) model, and the trading book model. The last of these emerged as a compromise between the different EU countries.

²¹ For a worked example of the CAD's methodology, see Price Waterhouse (1994).

²² The market risk capital charges for debt and equity instruments in the trading book would substitute for the credit risk weighted requirements that were applied to those instruments.

Portfolio risk for debt and equity risk categories is therefore a weighted average of the sum of their gross (for general risk) and net (for specific risk) positions. With regards to specific risk, weights are placed according to the quality measures of the security (issuer, maturity, rating). With regards to general risk, positions are aggregated and netted within each of 13 time bands. Net positions in each time band are then multiplied by a risk weight and aggregated across time bands. The netting of positions within a time band and aggregation of weighted positions across time bands - the so-called cashflow mapping - assumes perfect correlation among risk-free debt instrument price changes. These are later adjusted for imperfect correlations across maturity bands through so-called 'horizontal disallowances' capital charges, and basis risk within a maturity band through so-called 'vertical disallowances' capital charges.

Interest rate risk capital charges are separately determined for positions in each currency unit and are then aggregated across currency units using spot exchange rates to determine the total capital requirement for interest rate risk. Foreign exchange (FX) exposures, which are levied on the total firm's activities (that is, both banking and trading books) are assessed an 8% capital charge (once the net FX position exceeds 2% of the firm's own funds) on the larger of the sum of net short/long cash and forward positions in each currency. Alternatively, banks may use a 'backtesting' method for FX capital requirement, based on estimates of FX losses that would have occurred with their current positions, using their own VAR models (see section IV.2.), in the last five years. Commodity capital charges are generally 15% of the net position in each commodity except gold, whereby the FX requirements apply.

Derivative contracts in FX, interest rates and equities, are treated as if they were outright positions in the underlying securities, thereby allowing the relevant general and specific risk requirements to apply. Firm commitment contracts (futures, options, swaps) are expressed as long and short positions in the underlying instruments²³. Options

²³ For example, a futures contract to receive \$1 million in 5 year Treasury notes in 1 month is treated as the sum of:

- a long position in a 5 year (plus one month) note valued at its current market value, which is slotted in the 4-5 year maturity band;
- a short position in \$1 million 1-month T-bills, slotted in the 1-3 month band.

position risk may be included in capital measures under either the delta plus method (the value of the underlying instruments is weighted by the options' deltas, adjusted for vega and gamma risk) or the cave out method (risk is determined over a specified range of underlying security values and return volatilities). The resulting capital charge is added to those for other components of the portfolio. The division into specific and general risks for debt and equity risk categories, the calculation of separate capital requirements for each risk category, and their simple addition, is therefore what characterizes the BBA.

III.1.5. Qualifying Capital Under the CAD

Since capital requirements for market risk tend to be far more volatile than those of credit risk, a more flexible and less permanent source of capital was introduced. Tier 3, a new type of capital made up of short-term subordinated debt under a 'lock-in' clause²⁴, is eligible for inclusion in regulatory capital. This must have an initial maturity of at least two years. Tier 3 capital is only available to cover the risks dealt in the CAD - that is, trading book and foreign exchange requirements - while it is also subject to maximum limits in relation to Tier 1 and to total regulatory capital. Institutions will have to comply with the Directive requirements on a continuous basis meaning that daily monitoring and compliance mechanisms must be in place.

III.2. The Basle Standardized Measure (BSM)

III.2.1. Description of the BSM

The BSM is one of the two approaches suggested by the Basle Committee in its proposed market risk standard (see Section IV.2.). Like the CAD, the general approach proposed here is based on the BBA, whereby the capital charge calculated for each position is the sum of two components: a specific risk requirement and a general risk requirement. The capital charges thus calculated are intended to substitute for the credit risk weightings which have hitherto been applied to trading book items (debt and equity

²⁴ The clause prevents the payment of principal or interest in the event a bank falls below a given threshold percentage of the required market risk-based capital.

securities and derivatives) in deriving capital adequacy ratios. The investment book would continue to be subject to the provision of the 1988 Capital Accord.

III.2.2. Differences between the CAD and the BSM

Both the BSM and the CAD are minimum standards, leaving national authorities considerable latitude to apply additional requirements generally or to specific institutions. There are only a small number of divergences between the CAD and the BSM, the main ones being²⁵:

- with regards to the scope of coverage, the BSM is drawn up from a banking perspective, that is, it is only for banks (including bank holding groups) doing securities business. The CAD, in contrast, is targeted primarily at investment firms and then by extension at banks undertaking securities business. Moreover, the CAD is much more comprehensive - for example, it contains provisions relating to underwriting exposures and settlement risks which are not covered under the BSM;
- with regards to regulatory capital, the BSM, despite having a more lenient lock-in clause, is more restrictive on the use of short-term Tier 3 (subordinated loan) capital, as a percentage of original Tier 1 capital (own funds);
- with regards to gross equity positions, a more stringent approach to specific risk is adopted under the BSM, which does not allow the capital requirement (set at 8%, or 4% for highly liquid and well-diversified portfolios) to be lowered to 2%, as permitted under the CAD;
- with regards to foreign exchange risk, the BSM is more demanding, under its basic approach, in the capital charge it sets for an institution's net open foreign exchange position.

III.2.3. Overall Minimum Risk-based Capital Requirements

The combination of the Basle capital accords for credit and market risks means that banks will have to satisfy the following overall minimum capital requirements:

- the credit risk requirements from the application of the 1988 accord to the banking book - that is, excluding debt and equity securities in the trading book and all positions in commodities, but including the credit counterparty risk on all OTC derivatives in both trading and banking books;

²⁵ See Price Waterhouse (1994) and Hall (September 1995).

- the capital charge for market risk as a result of the application of market risk-based requirements, whether using the BSM or the IMA (see section IV.2.).

III.3. Analysis

III.3.1. Disadvantages of the BBA

A number of criticisms can be brought up against the BBA, as it has been encapsulated in the CAD and the BSM²⁶. Firstly, splitting a bank's business into a trading and a non-trading component, and applying separate and distinct definitions of capital to each, appears to make little prudential sense:

- requiring the firm to hold different amounts of capital if it has holdings in a particular security in both its trading and banking books is not consistent with the stated aim of regulation as being neutral between different transactions. Moreover, the trading book concept is open to regulatory arbitrage in the form of switches between the banking and trading books. Given the existence of incentives because of the differential capital rules, banks can be motivated to present their longer-term investments as trading assets^{27, 28}. The implication is that for most large borrowers of investment grade status, securities market financing, especially securitization, becomes relatively cheaper to conventional bank borrowing. To the extent that the process is due to arbitrary differences in the regulatory treatment of different types of debt issued by the same borrower, important inefficiencies and distortions are introduced;
- artificially carving up the bank's business in two parts is not efficient in a portfolio sense since it ignores the possibility of transactions undertaken in the trading book which incidentally offset (hedge against) the exposures in the banking book. Hedging instruments falling within the trading book would continue to be subject to the credit risk-based capital requirements;
- while the trading book segregates assets used for trading purposes, as well as the regulatory capital used to back such assets, it does not segregate non-

²⁶ See Dale (November 1994).

²⁷ Assume that 8% regulatory capital cover is required for loans and (say) 2% for securities. Assume further that 50% of this capital is provided in the form of equity and that the target return on equity for the bank is 10%. A universal bank will then need to earn 0.4% on its loan assets, but only 0.1% on its securities assets, in order to meet its target return on equity.

²⁸ On the other hand though, many banks prefer to avoid the marking-to-market that comes with a switch to a trading book because of the fluctuations it causes to their earnings. Therefore, there are limits to the benefits of this type of regulatory arbitrage.

capital liabilities. This means that a mixed securities and banking business - for example, a universal bank - is free to use its deposit base to fund its securities trading book. The problem here is that, since bank deposits generally enjoy deposit protection, deposit rates do not incorporate a risk premium that adequately reflects the risks a bank incurs. In a sense, banks' activities are being subsidized if banks are permitted to use protected deposits to fund their trading book. This in turn provides incentives for excessive risk-taking (moral hazard) within the trading book²⁹. The separation of risk-bearing from risk-taking is one reason why banks are subject to such extensive and conservative regulation on the asset side. Moreover, deposit funding of securities business gives EU banks an important competitive advantage over investment firms;

- The mandatory 'lock-in' provision applicable to short-term subordinated debt does not provide the protection that is intended. A bank forced to invoke this clause in respect of its trading book, in effect defaulting, would immediately become suspect in the eyes of the marketplace, thereby risking a deposit run. Accordingly, a bank would feel compelled to make good any capital shortfall arising on its trading book so as to prevent the triggering of the lock-in. The presence of 'outside' short-term subordinated debt to back the trading book therefore increases the solvency risk for the bank, because such debt cannot in practice be used to absorb losses on the trading book. On the other hand, a parent bank that provides 'inside' subordinated debt to its securities subsidiary would have to hold bank capital against this exposure. There is therefore little purpose in segregating a bank's securities assets for capital adequacy purposes if the risks in this part of the business cannot be segregated from the bank.

Secondly, splitting market risk into specific and general risk provides an effective basis for allowing the offsetting of long and short positions. However, by splitting market risk in this way, the implication is that the two elements are independent (that is, uncorrelated). If that is true, then mathematically total market risk should therefore be the square root of the sum of the squares of the two components, rather than their simple addition. In adopting the latter approach, it can only be presumed that the Commission considered it to be a sufficient approximation for total market risk.

²⁹ These difficulties could be avoided or at least alleviated, in principle, if there existed funding rules that prevented or limited the use of deposits to support a bank's trading book and instead required funding in the form of outside 'risk money', the cost of which would depend on the perceived risk characteristics of the institution concerned. For such a funding rule to be effective, however, it would be necessary to have banks' securities activities conducted through separately incorporated entities.

Moreover, complaints have also been directed at various rules within those two categories:

- the CAD rules treat all equities equally, recognizing no qualitative distinctions such as the identity or credit rating of the issuer, and the market on which the equity is quoted or traded;
- the CAD and BSM capital provisions for foreign exchange, large exposures (especially underwriting), and derivative transactions, are seen as being excessively high;
- neither the CAD nor the BSM indicate specific levels of capital to be maintained against interest rate risk on the banking book, perhaps in the belief that the existing credit risk framework is effective in capturing those risks;
- positions of the same sign in different securities or maturities are not assigned any diversification benefits.

These criticisms are the inevitable result of the adoption of a set of rule-of-thumbs that crudely assigns risk charges to specific instruments. Risk is treated as though it can be evaluated separately by security type and maturity, in contrast to modern portfolio theory.

The result is that:

- firms hold too much capital because some of the benefits of diversification and hedging are ignored;
- effective risk management is not encouraged since it is not aligned to industry's best practice, that of sophisticated in-house risk measurement and management models;
- it will be difficult to adapt the proposal to new products, because of its static nature³⁰.

Finally, another controversial issue with respect to the CAD, and not discussed here, is the desirability and feasibility of a level playing field between banks and investment firms in EU countries. The reason is the different views taken by regulators

³⁰ See Brickell, "New Tools for New Rules" in *Risk* magazine, Vol. 7, No. 1 (January 1994).

for the two types of financial institutions, focusing more on solvency and systemic risk for banks, and liquidity and customer protection for securities firms³¹.

III.3.2. Conclusion

Much will depend on the manner in which these provisions are implemented by the national authorities, as well as on the institutional framework, particularly differences in accounting practices³². One important advantage of the BBA that is readily apparent, based on the experience of the 1988 Basle credit Accord and given the similarity in the methodology that these two approaches share, is the willingness of many countries to implement regulations, such as this one, that are relatively simple to follow.

However, it is fair to say that the BBA is not a very efficient approach to measure, and take provisions against, market risk. The 'one-size-fits-all' approach does not reflect the diversity of portfolios and strategies that exist, nor does it keep up with changing circumstances. Moreover, though the opportunity for gaming the rules by financial institutions is present in all types of regulations, the BBA is particularly vulnerable because of its crudeness. The fundamental problem is that the procedure for measuring market risk is crude and it is at variance with industry best practice in risk measurement, the use of sophisticated in-house models (see next Section).

³¹ For a critical discussion on this issue, see Dale (November 1994).

³² Price Waterhouse (1994) lists the following accounting considerations: the extent to which assets and liabilities can be offset against each other; the rules governing hedge accounting; the valuation of securities positions; the methodologies employed in marking derivatives to market; and the application of NPV accounting techniques to value and report financial instruments.

IV. THE INTERNAL MODELS APPROACH

IV.1. Market Risk Measurement: Value-at-risk Models and Stress Tests

IV.1.1. VAR Models

In the past, banks have usually measured the risks in individual parts of their trading books separately. Nowadays, however, they are increasingly moving towards a whole trading book approach using a value-at-risk (VAR) model, which is a statistical approach to the evaluation of market risk. The aim of the VAR model is to calculate consistently the loss, with a specified probability over a specified holding period of time, that a bank might experience on its portfolio from an adverse market movement. For example, with a confidence interval of 97.5%, corresponding to about two standards deviations from the mean, any change in portfolio value over one day resulting from an adverse market movement will not exceed a specific amount x , given the relationships between assets holding over the observation period. VAR should therefore encompass changes in all major market risk components (see Section II.1.).

There are three main VAR approaches³³. Firstly, under the variance/covariance (or correlation) approach, a bank uses summary statistics on the magnitude of past price volatilities and correlations between price movements to estimate likely potential losses in its trading portfolio. This can be done by placing equal weights on all past observations or, in order to give more weight to more recent observations so that large jumps in volatility/correlation in the distant past are avoided, by using unequal weighting³⁴.

Secondly, under the (historical) simulation approach, a bank bases its expectations of potential future losses on calculations - using data on past price movements - of the loss that would have been sustained on that book in the past. The main difference between the two is that, with the first approach the confidence interval is calculated

³³ See Jackson (May 1995), and "Value At Risk", a *Risk* magazine Special Supplement (June 1996).

³⁴ The two most used methods for unequal weighting are the Garch (General Autoregressive Conditional Heteroscedasticity) family of models and the exponentially-weighted moving averages method.

statistically³⁵, whereas with the second approach it is observed. The latter approach is, therefore, computationally more intensive and its results are susceptible to the frequency of rare events in the historical observation period, as well as to its length.

Finally, under the Monte Carlo (or stochastic simulation) approach, a bank tests the value of the portfolio under a large sample of randomly chosen combinations of price scenarios, whose probabilities are based on historical experience. This method is more flexible and is particularly useful in measuring the risk in instruments with nonlinear price characteristics, but it is less frequently used because of its time and cost demands.

Banks can use any of the three approaches to allocate capital between their various operations. So far, there is no industry consensus on the best method for calculating VAR. As with any statistical model, VAR depends on assumptions whose choice is dictated by the user's awareness and aversion to them.

The issue of correlations is extremely important for VAR models. Different approaches capture different correlations³⁶. Measuring correlation is important because of the empirically well-established 'fat' tails in the distribution of market returns. Leptocurtosis means that measures of VAR based on a normal distribution of returns will likely understate actual VAR.

In addition, during extreme market movements, correlations change significantly which has implication for VAR measurement. During the October 1987 equity markets crash, the correlation between markets was close to 1 - all markets moved together. There is little benefit at such times from market diversification, but considerable benefit from having long and short positions in different markets. At other times - for example, after the 1987 Nikkei equity index crashed alone - the correlation between some markets was closer to zero, or even -1. The benefits from diversification then would much exceed the benefits from hedging.

³⁵ For example, one version of the first approach assumes that the returns on risk factors are normally distributed, the correlations between factors are constant, and the delta of each portfolio constituent is constant. All of these can be criticized as unrealistic.

³⁶ The variance/covariance approach, for example, is based on average correlations calculated for the whole data period, while the simulation approach reflects the actual correlations on particular days.

IV.1.2. Stress Testing

For the risk profile of a trading book, and for day-to-day risk management, it is short-term 'normal' correlations that are important because of the daily marking to market of positions. However, for the regulators, it is instances of extreme market pressure, when correlations can change dramatically and market liquidity drains, which are the focus. The emphasis therefore of regulation is on the tails of the distribution of price movements, that is on adverse extreme events. This is also the explicit aim of stress tests, the other main market risk measurement device.

Stress tests calculate the possible extent on a trading book of exposures under extreme market movement scenarios or, more generally, when some of the basic assumptions underlying the VAR model are violated. The trading book is revalued according to imposed hypothetical, albeit improbable, parameters, rather than according to summary statistics calculated from past data as in the variance/covariance approach. As such, there is no standard way to do stress testing since it involves experimenting with the limits of a risk model.

IV.2. The Basle Internal Model Approach

IV.2.1. Overall Description

As a result of the public criticism of the BSM proposals, the Basle Committee has, in its final market risk standard decision³⁷, agreed to include the IMA as an alternative approach to the BSM. The market risk standard covers the trading account of internationally active banks only. There is going to be a two-year implementation period, followed by the adoption of the standard, on a voluntary basis depending on the decision by the country's regulatory authorities, on the first of January 1998.

The assumptions underlying the BIMA are that banks are in a better position than regulators to devise models that accurately measure risk exposure over a holding period of concern to regulators, and that the regulatory authority can verify that each bank's

³⁷ See *Basle Committee on Banking Supervision* (January 1996).

model is providing such an accurate measure. In effect, the regulators ‘piggyback’ on a bank’s existing risk-management model to determine levels of risk capital to be held. At the heart of this approach lies the VAR model described above.

*IV.2.2. The IMA Process*³⁸

Setting capital adequacy standards under this regime is a three-stage process. Firstly, the regulators set the quantitative standards (risk parameters) for capital calculation which are the following³⁹:

- the model must cover all material risks in the trading book and must have a minimum number of thirteen (six for United States banks, under the corresponding Fed proposal) risk factors (maturity bands). Moreover, it must be able to account for the non-linear pricing characteristics of option instruments;
- a 99% one-sided ‘conservative’ confidence interval, in order to account for adverse movements only. This amounts to a risk estimate of three standard deviations away from the mean of a normal distribution of portfolio value changes;
- a ten trading-day (that is, two weeks) holding period. This has been imposed to extend the period sufficiently to be of interest to regulators, and can be justified by appealing to concerns about illiquidity and the inability to wind down positions during extreme market movements;
- a minimum of one year as the observation period for historical data to be used in calculating volatility, to be updated at least once a quarter. This is intended to resolve problems of differential volatilities and correlations arising from the choice of the size of the sample period;
- all correlations are allowed, both within and across different asset classes (risk categories), to be estimated with equally-weighted daily data;

³⁸ See the *Federal Register* (25 July 1995) for a more detailed description of the BSM and the BIMA as proposed to be applied to the United States.

³⁹ Quantitative standards were placed in an attempt to make consistent estimates across institutions. This was in response to important differences in model practice, identified when the Basle Committee compiled and distributed a test portfolio to fifteen banks in the major G-10 countries in order to get their VAR estimates. Moreover, the standards aim to address some overall measurement shortcomings. See *Basle Committee on Banking Supervision* (April 1995).

- since there is no economic model for determining how to extrapolate daily VARs to the ten trading-day holding period, that regulatory capital requirement is scaled up by the square root of time. Options exposures, which have nonlinear payoffs as a function of time, must be measured directly by considering the variance of two-week price movements. This can be done through nonlinear approximation methods involving higher-order risk factor sensitivities (gamma risk), volatility changes (vega risk), and spread risk;
- the bank's capital charge is based on the larger of the bank's previous day VAR estimate, and the average of its risk estimates over the prior sixty business days subject to a multiplication factor. This minimum scaling factor is included as a measure of the regulators' conservatism regarding the model's capital estimates. The proposed minimum value is 3, making the implied holding period equivalent to 90 days of unhedged exposure. The multiplier can be increased if the supervisor is not satisfied with the accuracy of the estimates (see 'plus factor' below);
- an additional capital charge for the specific (idiosyncratic) risk of trading book debt and equity positions is levied. This is equal to one-half of the specific risk capital charge as calculated under the BSM;
- for verifying risk estimates, a one-day backtesting methodology is proposed to be used quarterly, based on the frequency of realized daily losses exceeding the model's predicted losses at the 1% critical values⁴⁰. Banks are required to add to the multiplication factor a 'plus factor' directly related to the ex-post performance of the model.

Secondly, regulators must validate the VAR statistical models and processes which banks use to measure risk using the following qualitative standards:

- there must exist senior management oversight and active involvement in the process;
- the model must be fully integrated into the daily risk management process;
- risk management must be independent of the business line - that is, it must belong to an autonomous risk control unit;

⁴⁰ The main advantage of such tests is their non-parametric nature, that is they do not depend on implausible statistical assumptions like normally distributed asset returns. The main disadvantage is that the method implicitly assumes that historic volatilities and price movements will continue in the future, which may be inappropriate. There is as yet no industry consensus on the optimal methodology for backtesting, making it impossible to know whether a model has failed in a test because the model, and not the test itself, was faulty. See Cox, "Magic and Regulation" in *Risk* magazine, Vol. 8, No. 3 (March 1995).

- controls over inputs, data, model changes, and systems must be strong;
- the modeling system and the risk management process should be subject to an adequate, independent validation by the bank or a third party. This can be based on either, or both, the adequacy of the VAR estimates - for example, through backtesting and stress tests - and the documentation of the bank's policies and procedures.

Finally, the bank must estimate overall VAR capital requirements on a daily basis. As in the BSM approach, a third tier of eligible capital to cover market risks, made up of short-term subordinated debt subject to various restrictions, is provided here. Stress testing simulations are periodically going to be used in order to address concerns about the complexity and opaqueness of derivative instruments risks.

There are also rules regarding banks which temporarily use a combination of the BSM and the IMA approaches. The Basle Committee, despite setting no timetable, is keen to ensure that a bank which has developed one or more models will not be able to revert to measuring the risk using the BSM approach, unless the supervisor withdraws approval for the model.

IV.3. Analysis

IV.3.1. Advantages of the IMA

The main advantages of the IMA, as proposed by the Basle Committee, are the following:

- it does not generate excessive capital requirements for a widely diversified book in the way that the simple BBA does;
- it encourages sophisticated risk management by allowing the use of the same internal VAR model as the one for daily operations, and by rewarding continuous improvement (by way of lower capital requirements) in the way that models are built and risks are measured. By contrast, the CAD rules state that European banks are allowed to submit their VAR figures only if they are higher than the figures that would apply to them using the old BBA. This is rarely the case, implying that the incentive to improve risk measurement systems is not there;

- the supervisory task may be simplified compared to the BBA, since the regulator only has to set the risk parameters and validate each bank's risk assessment methodology. This argument is not universally acceptable though because of the problems that validation poses (see Section IV.3.2. below);
- it allows regulatory risk measures to evolve at the same time as risk measurement techniques used in banks' VAR models.

IV.3.2. Criticisms of the IMA

However, there are also some problems with the IMA. Some of the assumptions on which the approach is based have been challenged on various grounds⁴¹. Firstly, the regulators may find it extremely difficult to evaluate and verify the accuracy of sophisticated risk management models - a question of regulatory transparency and capacity. Since there is no standard regulatory benchmark model, an ex ante approach to validation is not possible. However, ex post verification through the comparison of the bank's prior risk estimate and the portfolio's subsequent performance, is unappealing. The reason is the low statistical power of such tests: is the violation a rare occurrence of a low probability event that exceeds the size of an accurately estimated tail probability, or is the bank's estimate of the probability of the event biased⁴²?

Secondly, extrapolation from single-day potential losses to longer periods does not adequately measure risk exposures. On the one hand, the process assumes a static portfolio position. In reality, a trading desk would be constantly adjusting its portfolio to reflect changing market conditions - the so-called endogeneity of trading risk⁴³. Over longer periods than daily, therefore, it is unrealistic to assume a fixed portfolio composition, especially during periods of significant asset price volatility, unless there

⁴¹ See Kupiec and O'Brien, "Internal Affairs" in *Risk* magazine, Vol. 8, No. 5 (May 1995).

⁴² The way the BIMA tried to resolve this problem was through the use of a large sample (one year of daily data or 250 observation points) and probability analysis. Specifically, it estimated the probability that the prediction of an accurate model would be wrongly classified as an exception at the 99% confidence level, and set a maximum number of exceptions per year of backtesting, beyond which a 'plus factor' would be activated.

⁴³ Stop-loss limits, a dynamic trading strategy, are examples of active risk management which is ignored here.

has been such a severe market movement that it is impossible to liquidate existing positions (the so-called ‘price gapping’), or enter into others (see Section V.2.2.).

On the other hand, there are two more problems with extrapolation, both of them purely statistical. One is that the true short-run distribution of primitive asset returns - those into which all positions are converted as units of measurement - is in practice not normal. The other is that the returns on primitive assets may not time-aggregate in a uniform fashion across different asset categories. Both compromise the accuracy of long-horizon risk estimates derived from one-day estimates. Moreover, option nonlinearities, if not adequately captured, invalidate the linear measure of trading risk exposure implicit in short-horizon risk measurement models due to curvature. It should be noted, however, that the criticisms of non-normality and curvature are not shortcomings of the models themselves but of the attempt to scale-up from linear, one-day VARs to the two-week horizon⁴⁴.

Thirdly, the various constraints imposed on banks’ internal models may create perverse incentives for banks in two ways⁴⁵:

- they may lead, in the extreme, to a second set of models maintained only for regulatory risk-based capital determination. This would allow banks to ‘adjust’ the constrained models in order to minimize their capital requirements. By micromanaging modeling, the IMA invites ‘gaming’ by the bank, in the same way that the BSM does;
- the choice of model parameters may be too conservative for the bank and internally inconsistent. For example, the arbitrary choice of a large multiplier number (3)⁴⁶, which came about as a compromise figure by regulators in different countries, may impose unduly burdensome capital requirements on most banks⁴⁷. Moreover, the proposed ten-day holding period assumption

⁴⁴ These weaknesses were recognized by the Basle Committee, which allowed them in order “to limit industry burden”. At the same time, however, the Committee has encouraged the switch by firms to a two-week full revaluation of their portfolio positions in market shock model simulations.

⁴⁵ See Bliss (September/October 1995), and Elderfield, “Capital Incentives” in *Risk* magazine, Vol. 8, No. 9 (September 1995).

⁴⁶ Other examples include the choice of a sixty business day moving average of daily VAR calculations and the imposition of an artificial floor on specific risk charges.

⁴⁷ Research by the International Swaps and Derivatives Association (ISDA) Task Force has shown that the core parameters of the capital set-aside alone provide enough capital cover of profit and loss movements

compromises the performance of meaningful backtesting. It will then be natural for banks to respond by reducing their effective capital costs. This can be done through the increase in their multiperiod risk relative to their daily VARs - for instance by increasing the use of option securities with nonlinear payoff - thereby gaming the regulations once again. Alternatively, they can simply choose to forego the development of their own internal models in favor of the BBA⁴⁸.

Fourthly, the VAR concept itself focuses solely on the probability of losses greater than a specified amount but totally ignores how large those losses are expected to be when they occur⁴⁹. Although the fixed VAR multiplier can be thought of as providing an additional layer of prudence, designed to account for the extent of maximum losses, as well as for possible market illiquidity and for leptokurtotic distributions of financial returns, the multiplier only addresses the average-loss distribution. This might not be so bad in the sense that the regulators now clearly delineate a situation of extreme financial stress, beyond which they can be expected to intervene. However, the system is open to gaming since banks can invest in projects that trade slightly higher expected returns for larger, though no more likely, potential losses.

Fifth, adjustments for conservatism are reflected in many of the BIMA's quantitative constraints, even though not all VAR measurement shortcomings err on the non-conservative side. This does not lead to a transparent risk measurement. Banks⁵⁰ have argued that, if regulators want to add conservatism, they should do it with other means

for the 1987 stock market crash, the 1990 Gulf War, the 1992 ERM crisis, and the 1994 bond market decline.

⁴⁸ This concern is already present in the *Financial Times* survey of derivatives (16 November 1995): "The reality for most UK banks is that the more traditional 'building block' approach... will ultimately require a smaller capital charge and therefore prove a cheaper alternative." (article by Richard Irving on shock-absorbing models). It is also confirmed in work done by members of the London Investment Banking Association (LIBA) and of the ISDA.

⁴⁹ Boudoukh, Richardson and Whitelaw, "Expect the Worst" in *Risk* magazine, Vol. 8, No. 9 (September 1995), suggest a measure related to stress testing, designed to measure maximum losses over a holding period, called 'worst-case scenario' analysis.

⁵⁰ See *J. P. Morgan* (2 August 1995).

- the multiplication factor, the 'plus' factor, or the confidence interval - but not by artificially building in assumptions which are not the best estimate of the model.

Finally, if we are concerned with the calculation of VAR on a liquidation basis as opposed to a 'going concern' basis, VAR can no longer be used with confidence to measure potential loss in the event of having to liquidate positions. The reason is that the liquidation horizon for any position cannot be arbitrarily set, as assumed under the conventional VAR measure, but depends on the costs of liquidation⁵¹.

IV.3.3. Conclusion

The IMA as proposed by the Basle Committee, and despite the adoption of the multiplication factor, is an improvement over the BBA since it caters to financial institutions' best practices by adopting their internal VAR models in the measurement of regulatory capital set-asides. To date, however, very few major banks carry full VAR models which include a complete matrix of correlations, because of the cost of setting up such internal systems. A combination of stress tests and VAR models on individual lines of business will continue to be the main instruments of trading book risk measurement, in order to compare against bank capital, for most banks for some time to come.

⁵¹ See Lawrence and Robinson, "Liquid Measures" in *Risk* magazine, Vol. 8, No. 7 (July 1995).

V. THE PRECOMMITMENT APPROACH

V.1. Description⁵²

V.1.1. Overall Description

An alternative to models-based regulation, the PA focuses on goals - namely, maintaining sufficient capital to cover trading losses - and leaves it to banks to determine the best models and inputs to achieve those goals. It is a relatively new idea in the field of regulation of market risk, floated by the Federal Reserve, and its specific mechanisms have not yet been set out in detail.

Under this approach, each bank pre-commits an amount of capital to cover what is believed to be its maximum trading loss exposure over a given regulatory horizon, which can be one quarter or even a shorter period. This capital becomes the focus of regulation. A bank would be in breach of this precommitment if cumulative losses from the beginning of the capital period exceeded its capital commitment on any close of business mark-to-market within the quarter. Banks that have good risk management systems, conservative portfolios, or more risk averse preferences, could precommit to lower maximum loss levels and hold less capital because of their confidence that they will not breach their precommitted maximum trading losses.

V.1.2. The Nature of the Penalties

Breaches would be penalized in two ways. Firstly, there would be explicit regulatory penalties. Secondly, the commitment could be publicly disclosed, providing a double incentive for the bank - to contain losses within its committed capital and to not greatly over-commit capital. The latter may send a signal of an ineffective risk measurement system, as well as of possible excessive risk exposure in the upcoming

⁵² See Kupiec and O'Brien, "Model Alternative" in *Risk* magazine, Vol. 8, No. 6 (June 1995); Bliss (September/October 1995); and Kupiec and O'Brien (December 1995).

period⁵³. It also encourages the regulatory authorities to act promptly over breaches, imposing the necessary penalties and determining management shortcomings. Disclosure therefore both complements and strengthens the incentives created by the penalties⁵⁴.

A number of regulatory punishment methods, individually or in combination, are envisaged, depending on the situation, if trading losses exceed banks' market risk capital precommitments:

- a fine penalty;
- an additional capital penalty. For example, banks could be required to hold capital in excess of their loss pre-commitments in subsequent periods. This has been criticized, though, on the grounds that it causes banks to respond to such a violation penalty by taking measures to nullify it⁵⁵;
- depending on the severity of the problem, supervisory actions could include less formal penalties such as supervisory sanctions. These could include a detailed review of the bank's risk management system, increased backtesting, close monitoring of activities, and even restrictions on trading activity or permitted risk exposure.

All penalties should have the important characteristic that they increase nonlinearly with the size of the violation⁵⁶. This requirement provides disincentives to deferring today's losses in the hope that future outcomes will reverse them, in an apparent attempt to 'bail the boat'.

Of course, in times of unusual financial market stress situations - for example, systemic crises - no reasonable capital commitment can fulfill those risks. Regulators

⁵³ This means that, for a bank which has excess regulatory capital, the implied cost of that capital is not zero, though it is probably less than the cost of penalties. The end result is that the banks will choose to be conservative.

⁵⁴ The usefulness of public disclosure has been questioned by market practitioners who believe that disclosed penalties might lead to market overreaction, which will cause runs on those banks that have breached their precommitment.

⁵⁵ For example, the bank could reduce next period's precommitment or increase the risk of its portfolio. Since precommitments are worst-case scenarios, actual violations would be rare and gaming therefore hard to detect.

⁵⁶ See Bliss (September/October 1995).

must therefore have the flexibility to waive penalties during those times. The issue of setting a penalty function becomes all-important for regulators since it sets the tone of incentives for compliance. In particular, that function must have the characteristic of perfect incentive compatibility, thus avoiding over- or under-commitment of capital.

Moreover, the multiplier used to determine capital set-aside from precommitted maximum losses need not be fixed at unity. While the system is being implemented, and until enough experience is gathered, a higher initial multiplier would provide an additional degree of safety. This precaution may be dispensed with time, though it cannot be used as an incentive device since it encourages gaming in the same fashion as capital penalties described above.

V.2. Analysis

V.2.1. Advantages of the PA

The precommitment approach has a number of significant advantages when compared to the other two approaches:

- it explicitly recognizes the role of risk management in determining a bank's market risk exposure over a relatively lengthy period. It does that by accounting for both the static internal model-based risk estimates, as well as active risk management during that period;
- it allegedly removes the need for supervisors to verify the accuracy of a bank's loss estimates. Its incentive structure uses the bank's self-interest to allocate appropriate capital and develop risk management systems. It therefore places the difficult task of assessing the maximum potential loss on the party best able to estimate and control it - bank management. This argument is not robust, however, since there are questions about the verification process (see Section below);
- it is flexible, though explicit, as to the type of penalty imposed. Penalties are an incentive device and a device for imposing costs in proportion to regulatory risk. They make explicit and bank-specific the costs that one-size-fits-all models-based approaches impose on banks;
- it compares favorably with the work hours required for implementing either of the two previous approaches. Reporting should not be costly, as the bank would simply announce only two numbers: its gains/losses for the previous period and its precommitment for the next period.

V.2.2. Disadvantages of the PA

The following are the main disadvantages of the PA:

- because penalties are applied ex post and only in the event of losses, the approach does not protect against a ‘go for broke’ strategy. In addition, precommitment suffers from verification problems through backtesting which are even worse than those of the BIMA because of the lack of plentiful observations available⁵⁷. Precommitment could, therefore, potentially impose penalties on a bank that a priori had set an appropriate capital commitment and had managed its trading risk very well. That is why the regulatory period should be as short as possible, in order to make it difficult for banks that have excessive losses early in the period to try to reduce them by undertaking more risky positions. Moreover, it is up to bank regulators to identify in advance banks for whom penalties would not act as a deterrent;
- a specific proposal linking the cost of regulatory capital to the bank has not yet been articulated. This is an important issue, since the same penalty, as well as the regulatory capital commitment, will cost differently for different banks, depending on, among other things, the bank’s leverage ratio;
- precommitment, though still relying on the authorities’ safety net, removes from supervisors the authority to determine instances beyond the capacity of the industry’s capital base to absorb - that is, a situation of unusual financial stress - because firms are free to choose all quantitative parameters;
- precommitment assumes that there is a time frame large enough for losses to be recouped by management through various stop-loss strategies. While this is appropriate for ordinary trading days, it was not the main objective of the Basle Committee in establishing market risk capital. Instead, the Committee’s intention was to tackle instantaneous market shocks, when market liquidity evaporates and there is little opportunity for stop-loss trade. In fact, trying to execute such a strategy can be counterproductive by actually increasing systemic risk, as was shown in the 1987 Wall Street crash. Precommitment, by encouraging a bank to rely more on stop-loss behavior in order to limit cumulative losses, can actually increase systemic risk.

⁵⁷ The standard PA proposal assesses penalties only once a quarter, in contrast to the daily observations for the BIMA. That gives it a much smaller sample on which to base its verification procedure.

V.2.3. Conclusion

The PA represents a substantial break from past proposals since, in its broad methodology, it is more market-oriented and incentive-compatible than the previous two approaches. This could potentially reduce the distortions introduced by the application of capital-based regulations in the marketplace. There are severe doubts, however, about its operational parameters (type of penalties) and implications in achieving the aims of regulation, which need to be addressed before it can be practically useful. In any case, there are very few banks nowadays with the technological capability of sophisticated risk measurement and management systems which can be relied on for precommitment purposes, questioning the approach's relevance, at least for the near future.

VI. CONCLUSION

VI.1. Evaluation of the Three Approaches to Regulating Market Risk

Regulators traditionally have utilized simple, generic models to measure bank capital adequacy. This is no longer possible: the increased presence of market risk in banks, and the opaqueness of such risk in a portfolio, have rendered such an approach obsolete. Three main alternative approaches, outlined in this paper, have emerged to replace it. An evaluation of them is based on an assessment of the extent to which they fulfill the objectives of bank regulation subject to the competitive neutrality and efficiency constraints. Each approach must therefore be judged on the tradeoff between the prevention of the costs of bank failures, and the costs of implementation of such regulations.

In a first-best world, appropriate measurement of risk, which would incorporate all four types of it, of the whole institution in accordance with a portfolio approach⁵⁸, should precede the setting of risk-based capital standards. That time has not come yet, though all three approaches move towards that direction; we therefore have to continue to resort to piecemeal regulatory capital requirements.

The VAR concept can potentially be applied to both credit and market risk, thus allowing for the possibility that, in time, banks may be able to have a single firm-wide measure of those risks across all business areas, and so measure return on (credit and market) risk consistently across the whole firm. The concept, however, is no substitute for the wider risk management process of analyzing stress scenarios and keeping tabs on operational and legal risks. For example, neither the VAR, nor any of the other two approaches, offers a direct solution to the problem of operating risk - the existence of sloppy internal controls - which has been responsible for many of the recent scandals involving derivatives.

In addition, a number of complementary reforms must also take place in order to reach the first-best solution, including the implementation of a cohesive accounting

⁵⁸ See Dimson and Marsh (July 1995).

framework⁵⁹ and the switch in financial regulation towards a functional, as opposed to an institutional, perspective⁶⁰. The CAD is an example of functional regulation at a broad level because it regulates similar activities between securities firms and banks, though there are questions about the wisdom of doing that (see Section III.3.1.). However, at a narrower level, it ignores the market risk found in the banking book and, with the exception of forex risk, it focuses exclusively on the trading book.

The building bloc approach is problematic because it is inflexible, and thereby inefficient in accurately measuring risk, and static. By focusing on the classification of instruments rather than risk types⁶¹, it distorts different instruments' attractiveness, it ignores portfolio principles of diversification and correlation hedging, and it encourages substantial gaming. It has to be admitted though that, based on the experience of the credit standards introduced in 1988, the willingness of countries to implement risk standards may be positively related to their relative simplicity, notwithstanding the unrealistic assumptions they may involve.

The internal model approach is an improvement to the BBA, since it is aligned to bank industry best practice, the use of internal VAR models. However, the attempt by regulators to create consistent estimates of VAR across different institutions' models, as well as their conservative parameters, have reduced the approach's appeal. In addition, at least in the near future, its application will be limited to a relatively small number of institutions (about 25 in the USA, according to the Federal Register) that have both material trading activities and sophisticated, comprehensive VAR models.

⁵⁹ Current accounting principles (more than practices) do a good job at valuation, inherently a static measure of financial conditions. However, they are totally inadequate to deal with risk allocation and exposure, which is of critical concern nowadays.

⁶⁰ See Merton (April 1995). He argues that regulation organized along functions, as opposed to institutional categories of products or asset types, would be operationally more effective and comprehensive. The reason is that it will be increasingly more difficult and distortionary to regulate along traditional institutional lines because the flexibility in contract designs would by-pass those regulations.

⁶¹ As seen in Section I.2., in order to calculate the true market risk of a particular institution under some confidence interval, it is necessary to disaggregate income down from individual transactions to its fundamental elements, and then aggregate them up again while taking into account any correlations between different risks.

In contrast to the first two approaches which support model-based regulation, the precommitment approach by-passes the micro-management of banks' models, focusing instead on outputs. If appropriate incentive-compatible penalties are found, the incentives for gaming by banks, present in different ways and extent in both BBA and IMA (and all financial regulations), are significantly reduced. It is necessary though for the PA to be further examined and refined, given the severe doubts that still exist over the implications of its adoption in practice.

In conclusion, given the current inability to develop measures which capture an institution's overall portfolio risks, the use of piece-meal regulatory capital requirements, such as the one for market risk, should continue. Of the aforementioned approaches, the internal model approach is, for the time being, the most reliable, market-friendly, and effective method that can be eventually achieved for most banks.

VI.2. Business Implications of the New Market Risk Rules

VI.2.1. Dimensions of Assessment

There are a number of potential business implications arising from the new market risk rules, though they are still tentative in nature⁶². The implications arise primarily out of the implementation of the BBA, through the CAD and the BSM, and to a lesser extent from the IMA. They can be seen in three dimensions: capital, competition, and profitability and pricing decisions of banks.

VI.2.2. Implications for Capital

With respect to capital, the initial reaction of many banks and of the EU Commission has been that the application of the new rules will not result in significantly increased levels of capital, in contrast to the implementation of the Basle Accord of 1988 for credit risk. For banks, the existing rules for credit risk will continue to be the primary rules determining the overall regulatory effect. This is because of two reasons.

⁶² See Price Waterhouse (1994).

Firstly, despite the recent growth in banks' market-related activities, the size of banks' market exposures is generally small relative to traditional credit-related exposures. Secondly, regulatory capital requirements for market risk do not appear to be as binding as those for credit risk were - banks empirically seem to already hold back enough capital for trading book activities, perhaps because of their still uncertain and evolving models of market risk pricing. Most banks would be expected to meet their regulatory capital needs from share capital and other long term sources. Indeed, the unavoidable systems costs of adapting to the new regime may prove the main business issue.

VI.2.3. Implications for Competition

With respect to competition under the BBA, the key issue is the flexibility with which regulators in different countries will police the trading book/banking book divide to ensure neutrality, in capital terms, between banks and investment firms. Geographical and other factors will limit the ability of financial institutions for regulatory arbitrage.

However, given the crudeness of the different risk charges for different instruments embodied in the BBA, it is probable that niche players and small independent firms, depending on the types of investment services they provide and consequently the risk exposures they are involved with, are likely to face onerous capital requirements. It is the biggest trading banks with the most well-developed risk measurement systems that stand to gain the most, though not the extent that they would like, given the conservative parameters imposed on their models by regulators. Barriers to entry for proprietary trading in banks will therefore increase. Moreover, the cost of regulatory capital will increase the pace of banks' search for new non-capital consuming lines of business and thereby increase the level of competition in these areas.

It is unlikely, however, that any accord on capital can have a major impact on competition among banks in different countries. Such competition is determined primarily by differences in comparative advantage, the fundamentals of each economy, and government support in the form of safety net policies, and not by pre-existing differences in capital ratios. As with the Basle credit risk accord, the new market risk capital requirements cannot be justified, or judged, mainly on competition-enhancing

grounds - the leveling out of the playing field - but rather on their effects in strengthening the safety and soundness of the banking system, both nationally and internationally. It is true though that, depending on the original bank organizational structure and regulatory framework in place, the effect of the imposition of these capital rules might differ⁶³.

VI.2.4. Implications for Profitability and Pricing

With respect to profitability and pricing, the new rules will add to the costs of most firms conducting securities business, particularly in the installation of new risk measurement and internal control systems. A firm may have to overhaul and reorganize its IT systems in order to be able to ensure compatibility and information-sharing across all its, perhaps worldwide, offices. However, if this will also confer the firm a competitive advantage, or is necessary because of increasing globalization and competition, then the costs would have been incurred anyway, and might even be recouped through better risk pricing or greater market share.

However, firms' pricing decisions are the result of a multitude of factors, of which regulatory capital is only one. It is not therefore expected that pricing policies are going to be substantially altered upon the implementation of these rules.

⁶³ For example, a US bank holding group would probably suffer greater costs applying the Basle BBA to its consolidated accounts (in addition to the application of the SEC's Comprehensive Approach to its securities affiliate), than a German universal bank in keeping the same standard.

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